THE ECOLOGY OF HONEY CREEK

A PRELIMINARY EVALUATION OF THE INFLUENCE OF *SIMULIUM* SPP. (DIPTERA: SIMULIIDAE) LARVAL POPULATIONS ON THE CONCENTRATION OF TOTAL SUSPENDED PARTICLES.[1]

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ABSTRACT: *Simulium* spp. populations filtered significant quantities of suspended particles from Honey Creek as indexed by the differences in Coulter Particle Counts taken upstream and downstream from larval concentrations. These differences were not correlated with water temperature, depth, current velocity, or *Simulium* spp. benthic density, but were inversely correlated with total numbers of larvae.

DESCRIPTORS: Simuliidae larvae, suspended particles, particle filtration

Simulium spp. larvae are predominantly filter feeders straining suspended particles from the water by means of their cephalic fans (Carlsson, 1962; Ivasshenko, 1972; Hynes, 1972; and many others), but also occassionally feeding on periphyton (Burton, 1973) and other blackflies (Burton, 1971). The aufwuchs travertine community at Honey Creek, Murray County, Oklahoma supported dense populations of *Simulium* species A, *S. virgatum* Coquillet, and *S. trivittatum* Malloch in specific microhabitats with favorable current relationships (Reisen, 1974). These organisms were assumed to feed randomly on size specific suspended particles as was determined by a preliminary evaluation of gut contents. Other filter feeders such as the Hydropsychidae (Trichoptera) have been found to show a positive relationship with the amount of suspended particles, i.e. food, as indexed by Coulter Particle Counter evaluation of water samples (Williams and Hynes, 1973). The purpose of this investigation was to determine: 1. if simullid larval populations could significantly reduce the quantity of suspended particles as indexed by changes in Coulter Particle Counter data; and 2. if this removal of particles varied with temperature, depth, current velocity, and simuliid larval abundance.

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METHODS AND MATERIALS

Simullid benthic densities and the calculation of population area and total numbers followed the procedures outlined in Reisen (1974). Water temperatures were measured concomitantly with a field thermometer; depths were estimated with a ruler; and current velocities were measured with a modification of Darcy's Pitot tube (Reisen, 1974). Duplicate 5 ml water samples were taken immediately above and below larval blackfly concentrations and were fixed in the field by mixing with 100 ml of commercial Isotone. Samples were then taken back to the laboratory and the total number of suspended particles estimated by means of a Coulter Particle Counter (Reisen, 1974). Triplicate counts were made along with a background count for each sample. Counts were averaged, corrected for background "noise" and expressed as counts/ml. Operating parameters for the Coulter Particle Counter have been presented previously in Reisen (1974). Differences between the upstream and downstream readings were calculated by averaging the duplicate samples and then taking the difference between the means. This difference was attributed to the number of particles removed from the water by the actively filtering blackfly population.

Differences between the upstream and downstream readings were evaluated statistically using a 2 way factorial analysis of variance with replication. The main effects were considered random and the differences were tested using the interaction term (Sokal and Rohlf, 1969). Factor interactions were evaluated using the simple product moment correlation coefficient (Sokal and Rohlf, 1969).

RESULTS AND DISCUSSION

The environmental conditions, *Simulium* spp. larval population parameters (*S. virgatum, S.* species A, and *S. trivittatum* pooled), and the number of suspended particles removed by *Simulium* filtration are presented in Table 1 and the correlation among these presented in Table 2. Blackfly larvae were able to remove a significant number of suspended particles as particle counts taken above and below larval concentrations were significantly different (F ratio = 7.788, $\alpha = 0.05$). The number of particles removed was independent of benthic density, water temperature, depth and current velocity which was in good agreement with the findings of Reisen (1974), but was significantly negatively correlated with the total number of individuals in the population. This relationship was difficult to interpret for it would seem that the number of particles removed would be proportional to the number of blackfly larvae

Table 1. Environmental conditions, *Simulium* population parameters, and the number of suspended particles removed by *Simulium* populations as indexed by differences in the number of coulter counts in samples taken upstream and downstream from *Simulium* concentrations.

Date	Water Temperature (°C.)	Depth (cm)	Current Velocity (cm/sec)	*Simulium* spp. Benthic density (Nos/cm^2)	Population Area (cm^2)	Number in population	Differences in the Number of Coulter Counts (cts/ml)
8 Jul 72	26	–	126.15	5.949	–	–	17104.33
15 Jul 72	28	–	130.00	5.564	–	–	6800.00
22 Jul 72	28	5.00	136.84	7.360	–	–	8567.50
29 Jul 72	29	2.54	–	7.949	–	–	6305.00
5 Aug 72	29	2.00	–	6.770	3445.15	23322.66	4785.00
19 Aug 72	25	2.50	207.53	9.487	860.00	8158.82	16476.00
9 Sep 72	29	2.54	193.52	5.357	11483.00	61523.58	2987.50
23 Sep 72	20	2.00	200.00	10.356	13000.00	134631.90	4090.00
14 Oct 72	25	1.91	237.02	1.878	25187.05	47308.84	6063.00
22 Oct 72	17	1.90	237.02	4.590	37741.86	173220.04	115.00

Table 2. Simple product moment correlation coefficients between the number of suspended particles removed by the simuliid populations and environmental conditions and simuliid population parameters.

Parameter	Number of Replicates	Correlation Coefficent
Water temperature	10	0.2645
Depth	8	0.3221
Current velocity	8	-0.4642
Benthic density	10	0.2756
Total number in population	6	-0.7034*

*Significant at $\alpha = 0.10$

present between sampling locations. Perhaps the older, larger larvae consumed more particles than younger, smaller individuals which were more numerous. Normal population attrition through mortality and/or emigration would reduce total population numbers while the filtration rates could have remained constant or even increased since total cohort biomass was observed to remain relatively constant (Reisen, 1974).

Particles cleared were predominantly between 3 and 10 cubic microns in size and consisted of both organic and inorganic debris as well as bacteria. A single water sample was filtered through a millipore filter and the residue streaked on nutrient agar. The resulting bacterial colonies were predominantly gram (-) rods which were considered suitable food for simuliid larvae (Fredeen, 1964).

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